

A DEVICE FOR AIR CLEANING FROM DUST AND AEROSOLS

5

Cross-Reference to Related Disclosure

The present application is a U.S. National Stage application claiming the benefit of prior filed International Application, serial number PCT/RU01/00247, filed June 21, 2001, which International Application claims a priority date of March 27, 2001 based on prior filed Russian Application serial number RU2001/107867.

Technical Field

15 The present invention ~~relies~~ relates to separation of disperse particles with the use of ~~the an~~ electrostatic effect, to be more precise, the present invention ~~relies~~ relates to devices aimed at ~~air~~ cleaning ~~from~~ dust and aerosols from the air. The invention ~~can find~~ has applications in all fields of industry as well as in domestic rooms.

20

Background art

~~A One device contained in the prior art~~ comprises a body with an air inlet, ~~and corona-forming and precipitation electrodes of opposite polarities. Near precipitation electrodes,~~ An electrostatic precipitation element is installed near the precipitation electrodes. Said ~~The electrostatic precipitation element is effected comprises~~ of two metal nets with precipitating fabric set in-between (for ref. see Inventor's Certificate of the USSR No. 921629, class B 03 C 3/08).

The above-mentioned known device does not avoid extraction of harmful ~~for health~~ positively charged ~~aeroions~~ aeroions. Additionally, ~~as well as it the system~~ does not provide for saturation of cleaned air with molecules of aromatic or medical substances if necessary.

30 As to its principle of operation, the proposed device is closest to a device described in the Patent of Russian Federation No. 2159683, class B C 3/04 published in 2000. This known device comprises a body with an air inlet, Located inside the body are corona-forming and precipitation electrodes with opposite polarities, passive electrodes are set,

behind electrodes an electrode – generator of negative electrodes being electrically coupled with precipitation electrodes and a vessel with aroma or medical substances are mounted.

The principle ~~of work of~~ upon which the prior art device is based ~~on~~ is the forming of charged particles in the field of corona-forming charge appearing between positively charged corona and negatively charged precipitation electrodes. Corona-forming and deflecting electrodes have similar polarities but different electrical potential in relation to precipitation electrodes. The presence of deflection electrodes increases level of purification of air greatly (up to 95 – 99 per cent). Passive electrode acquiring positive charge prevents positively charged aeroions from leaving air cleaner thus preventing an accommodation environment from being polluted with harmful positively charged aeroions. Said air cleaner ~~while operating provides for the~~ forming of negatively charged aeroions of oxygen in great amounts ~~quantities~~. A ~~part-portion~~ of these ions ~~being-are~~ seized by means of dust or aerosols particles ~~are-and then fallen~~ on passive electrodes thus covering electrodes with a dielectric fine dispersion layer. This layer of dust partially neutralizes positively charged electrodes but mainly ~~it prevents from its appearance thus decreasing~~ decreases the efficiency of the passive electrode as a precipitator of positively charged ~~ones-aeroions~~. ~~greatly~~ Therefore, it becomes ~~which leads to the necessity~~ necessary of producing quite often to cleaning of the passive electrodes, thus ~~effecting some inconveniences while exploitation~~ creating additional work and inconvenience.

The ~~presence-use~~ of a vessel allows ~~performing~~ saturation of the air with aromatic substances, however, liquid overflowing ~~out-offrom~~ the vessel is mixed with dust which has fallen. This situation makes the inner surfaces dirty, worsens electric isolation, safety and may produce electrical ~~shortings~~ failure. ~~Besides~~ Likewise, the intensity of liquid evaporation in a ~~netnon-~~ homogeneous electric field is ~~rather~~ relatively great, small amounts of liquid are evaporated very fast. thus ~~This requires~~ often frequent ~~recharges-refilling~~ of the vessel with aromatic or medical liquids. As the vessel is mounted inside air cleaner, such recharges are connected, as a rule, with partial or full reassembling of the device which leads to additional time and ~~facilities-expenditures~~ inconvenience. High aerodynamic resistance also reduces efficiency of the device.

SUMMARY OF THE INVENTION

~~The invention is based on the problem of providing a device for purifying of air from dust and aerosols, which, along with providing a possibility to saturate air with aroma and~~

medical substances is convenient at its exploitation and has a higher possibility of complex air treatment. One advantage of the present invention is a device which purifies air by removing dust and aerosols.

Another advantage of the present invention is the ability to saturate the air with aromatic and medical substances.

Still another advantage of the present invention is its ease of use and greater application for complex air treatment.

These objects are accomplished by that advantages are incorporated in a device for air purification ~~from~~ by removing dust and aerosols comprising a body with an air inlet, disposed inside said body are corona and collecting electrodes ~~are mounted~~ having opposite polarities, deflecting electrodes behind which an electrode-generator of negatively charged electrons is mounted. Said generator is electrically coupled with precipitation electrodes. In the body a ~~means~~ vessel for holding aromatic and medical substances is mounted, ~~according to the invention in front of corona-forming electrodes~~ a reflector of positively charged electrons is mounted in front of the corona forming electrode. The reflector ~~set~~ being is electrically coupled with the corona-forming electrodes, while ~~a means~~ the means for distributing aromatic or medical substances is ~~effected as~~ includes one or few ~~more~~ tapes made of porously-fiber material ~~which~~ whose ends are ~~included into~~ placed within the vessel ~~with containing the~~ aroma or medical substances being mounted beyond the body.

The proposed device allows ~~avoiding exclusions~~ for the removal of harmful ~~for~~ health-positively charged aeroions. ~~Additionally, in conditions of any long terms operation, but an additional cleaning of a reflector of aeroions from dust is not required~~ it is not necessary to clean any dust from the reflector. Direct measurements ~~has~~ have shown that concentrations of positively charged aeroions at the inlet ~~is~~ are decreased to tens of thousand, as well as the background values of positively charged aeroions concentrations at inlet of the device. This can be explained by the fact that the positively charged reflector pushes away aeroions ~~that are at~~ from the inlet of the air cleaner. While in operation, dielectric fine dispersion dust is collected on the reflector, nevertheless this fact does not lessen its efficiency, as it ~~is~~ constantly remains under a high positive potential. A layer of dielectric fine dispersion dust does not influence ~~much on~~ the dispersion of power-lines of the electrostatic field of a reflector. Thus, cleaning of the reflector is not necessary and it can be combined with the cleaning of precipitation and deflecting electrodes if necessary.

~~Replacement of a~~ Rather than relying on a vessel to hold aromatic or medicinal substances, with a wick-like tape made of porously-fiber material ~~(as a wick), which ends are~~

placed into capacities with aroma or medical substances, is used. The tapes allows reducing reduces aerodynamic resistance to air flow greatly as the thickness of the tape is not more than several millimeters. Additionally, problems associated with water or condensation coming in contact with the deflection electrodes is avoided. At the same time a possibility of water to drop on precipitation and deflection electrodes is avoided as well as free (open) surface of liquid is increased. As the capacities vessels for liquids are placed beyond operation zone of the device, refilling of the capacities vessels can be performed through special aperture by means of syringe or other known method without switching the device off the power source, through special aperture by means of syringe or other known method. There are no restrictions regarding the present invention's any limits in size of capacity capacities for aromatic or medical substances, in the proposed device. A plurality of tapes can be used rather than relying on a single wick-like tape. Instead of one tape made of porously fiber material in the proposed device it is possible to use two or even more tapes which ends are placed into capacities with aroma or medical substances, thus allowing forming bouquets of fragrances or medical mixtures.

To use the device in ozonization rate, according to the invention, accelerating electrode, to which a controlled positive potential is provided, is placed in some distance from electrode generator, said accelerating electrode is effected with a possibility of its movement in relation to electrode generator.

The present invention may also be used as ozonizer. This is accomplished by distancing the accelerating electrode (positively charged) from the electrode generator. The device is constructed so that the position of the accelerating electrode is adjustable in relation to electrode generator.

A According to the invention, high-frequency alternating current is provided to accelerating electrode.

To increase productivity and to raise the coefficient of purification of air from by removing dust and aerosols in the device, according to the invention, a few plurality of reflectors of positively charged aeroions, corona-forming, precipitation and deflection electrodes are placed in sequence.

Brief description of drawings

The present invention will now be described in greater detail with reference to various specific embodiments thereof taken in conjunction with the accompanying drawings, in which:

Fig. 1 illustrates a general embodiment of the proposed device;

5 Fig. 2 illustrates one of the embodiments of the proposed device.

Detailed Description of the Preferred Embodiments

10 The proposed device comprises a body 1 (Fig.1) with valve 2 for air, said valve having inlet and outlet (not shown in Fig.1). ~~Air input to canal 2 enters the device through valve 2, shown in the drawing Fig. 1 being shown by means of "A" arrow, while air output is shown by means of "B" arrow.~~ Inside the body corona-forming electrodes 3 (positively charged) and precipitation electrodes 4 (negatively charged), as well as deflecting electrodes 5 (positively charged) ~~are established.~~ Voltage volume supplied to the deflecting electrodes 5 is less than voltage volume supplied to the corona-forming electrodes 3 and precipitation electrodes 4. In front of, and parallel to, corona-forming electrodes 3 ~~and parallel to each of them,~~ a reflector of positively charged aeroions is ~~established placed~~ at a distance. Said reflector ~~is effected as~~ includes electrodes 6 electrically coupled with electrodes 3, electrodes 6 having bigger diameter than that of electrodes 3.

20 Behind deflection electrodes 5 an electrode-generator 7 of negatively charged aeroions is established, being electrically coupled with precipitation electrodes 4. Said electrode-generator 7 ~~may be effected as~~ comprise an electro-conducting net made of thin wire and ~~is may be~~ equipped with concentrators ~~effected comprised of~~ as needles.

25 Corona-forming electrodes 3 in this particular embodiment are ~~effected constructed~~ as thin electricity conducting threads made of tungsten wire of a relative diameter, ~~while~~ ~~Reflector-electrodes 6 are effected constructed~~ as rods made of stainless steel of round-section with a diameter about 10 – 20 times as big as ~~greater than~~ that of electrodes 3. Precipitation electrodes 4 and deflection electrodes 5 ~~electrodes are effected constructed as~~ electricity conducting plates. All ~~above mentioned electrodes are established disposed~~ within body 1, made of a dielectric material, on electricity isolators-insulators 8.

30 ~~In front of electrode 7 one~~ One, or several, wick-like tapes 9, made of porously-fiber material (wiek) ~~which whose~~ ends are placed in vessels 10 ~~with containing~~ aromatic or medical substances, can be placed in front of electrode 7, beyond the body 1. Tapes 9 are

placed in the zone of the most-homogeneous electric field – i.e., between deflection electrodes 5 and electrode – generator 7 of negatively charged aeroions.

To use the device ~~in ozonization rate~~ as an ozonizer, an accelerating electrode 11 is placed at a distance behind electrode-generator 7 ~~at a distance an accelerating electrode 11 is established~~, a controlled positive potential is supplied to said electrode 11, a controlled non-homogeneous electric field is formed between electrode-generator 7 and accelerating electrode 11 ~~a controlled non-homogeneous electric field is formed~~. Change in volume and gradient of said field is ~~effected~~ achieved by means of either change of voltage volume between electrodes 7 and 11, or change of a distance between said electrodes due to replacement of electrode 11 in respect to electrode-generator 7.

To increase the productivity of ozone, change of corona-forming 3, precipitation 4 and deflection 5 electrodes' polarities is provided. Instead of direct current, a high frequency alternative current (50 kHz and up) may be supplied to electrodes 7 and 11 thus increasing volume of ozone produced.

Fig. 2 represents one embodiment wherein the efficiency of cleaning aust and aerosols from the air is achieved. ~~To enhance productivity and a coefficient of cleaning air from dust and aerosols one of the embodiments of the device is presented in Fig.2~~

~~Under such variant of the~~ In this embodiment ~~embodiment~~ several reflectors 6 of positively charged aeroions, several ~~corona-forming~~ coronaforming 3, precipitation 4 and deflection 5 electrodes are used.

~~The proposed device operates as follows:~~

Under supply of high voltage to corona-forming 3 and precipitation 4 electrodes a corona discharge appears ~~is created~~, thus forming a flow of positively charged nitrogen and oxygen ions directed towards precipitation electrodes 4, ~~this~~ This effect is called "ionic wind." Together with aeroions in the non-homogeneous electric field neutral molecules, as well as particles of dust and aerosols, contained in the air and moving towards precipitation electrodes are ~~being polarizes~~ polarized and charged. Particles of dust and aerosol, after being positively charged, are dropped to precipitation electrodes 4 while negatively charged particles are dropped to deflection electrodes 5. In addition, ~~besides~~ said particles produce a slowing-down effect ~~to very fine~~ upon positively charged particles which, due to their high velocity, can not be dropped to precipitation electrodes. Due to this, deflection electrodes 5 level of purification reaches 95 – 99 per cent. The ~~E~~electric field of reflector 6 ~~having~~ has positive potential thus prevents ~~preventing~~ harmful positively charged aeroions from leaving the device, it changes the direction of their movement to the opposite one thus directing

particles towards precipitation electrodes 4 thus increasing air purity. Corona-forming electrodes 7 established ~~disposed~~ behind deflection electrodes 5 saturate the air with negatively charged aeroions of oxygen. ~~A part of p~~Positively charged aeroions, having passed through slowing-down field of deflection electrode 5, ~~is being~~are changed when ~~upon entering a~~the zone filled with negatively charged aeroions of oxygen and electrons. In this case, ~~the~~ concentration of positively charged aeroions at ~~the~~ outlet is reduced considerably to their background level while concentration of useful negatively charged aeroions increases greatly. Direct measurements prove that in this particular case ozone is almost absent.

During ozonization ~~rate~~negative potential is supplied to corona-forming electrodes 3, positive potential is supplied to precipitation electrodes 4, while deflection electrodes 5 are supplied with negative potential of less value. To increase the amount of ozone produced electrodes 7 and 11 are supplied with high voltage, ~~which~~whose volume can be changed, thus, allowing controlling of ozone production in a wide range. It is noticeable that the efficiency of air cleaning from dust and aerosols under this particular rate is not lower than that in conditions of positive corona-forming while the amount of negatively charged oxygen aeroions is much greater.

Aromatic or medical substances are transferred through tape 9 made of porously-fiber material from vessels 10 to the zone of non-homogeneous electricity field under forces of inter-molecular interaction (known as capillary phenomenon). In said non-homogeneous field additionally Koulon forces are applied to polarized molecules of liquid, said forces are directed towards the raise in tension of electrical field. These forces reduce attraction between molecules thus promoting faster evaporation of aromatic or medical substances. Control over the intense of evaporation of liquid is provided by the fact that open (free) surface of liquid in the tape of porously-fiber material may be controlled in wide range. By means of cleaned air ~~flow~~ ~~molecules~~flow molecules of aromatic or medical substances together with negatively charged aeroions of oxygen are taken beyond air cleaner. Both the method described and the device proposed do not require any dissolvent polluting environment, as well as special sprays, inhalators and fans. While ozonization ~~rate~~air saturation with aromatic or medical substances is not recommended as non-controlled oxidation of said substances by means of ozone may take place.

Industrial applicability

The proposed device ~~can find its~~has applications both in ~~all kinds of industry~~industrial and ~~in domestic rooms~~capacities for saturation of air with molecules ~~of~~with aromatic and medical substances, negatively charged oxygen aeroions as well as with controlled amount

5 of ozone.

A DEVICE FOR AIR CLEANING FROM DUST AND AEROSOLS

5

ABSTRACT

10 A device for air cleaning from dust and aerosols based on the use of non-homogeneous electrostatic field creating a flow of charged particles (the so called "ionic wind") and operating as electrostatic precipitator ~~is proposed~~. The device comprises a ~~body~~ body ~~+~~ inside which corona-forming and precipitation electrodes with opposite polarities are established. Inside the body deflection electrodes are established as well, in front of corona-forming electrodes a reflector for positively charged aeroions effected ~~by an~~ by an as electrode ~~and electrically coupled~~ with said corona-forming electrodes being established. The ~~proposed~~ device comprises one or several tapes made of porous-fiber material placed into non-homogeneous electric field.

15